CLAIMS

1. A switching power supply circuit characterized by comprising:

a switching unit formed with switching devices, for performing switching so as to interrupt a direct-current input voltage input to the switching unit;

a driving unit for switching-driving said switching devices;

an isolated converter transformer for transmitting a switching output of said switching unit from a primary side to a secondary side, said isolated converter transformer including at least a primary winding and a secondary winding wound in the isolated converter transformer;

a primary side resonant capacitor connected to a predetermined part on the primary side so as to form a primary side resonant circuit for converting operation of said switching unit into a resonance type operation with at least an leakage inductance component of the primary winding of said isolated converter transformer and a capacitance of the primary side resonant capacitor;

a primary side partial voltage resonant circuit for performing a partial voltage resonant operation during a period that the switching devices forming said switching

unit are turned off, said primary side partial voltage resonant circuit being formed by a capacitance of a partial resonant capacitor connected in parallel with at least one of the switching devices forming said switching unit and the leakage inductance component of the primary winding of said isolated converter transformer; and

a synchronous rectifier circuit for providing a secondary side direct-current output voltage as a voltage across a secondary side smoothing capacitor by performing rectifying operation on an alternating voltage induced in the secondary winding of said isolated converter transformer and charging said secondary side smoothing capacitor with a rectified current;

wherein said synchronous rectifier circuit includes:

a first field-effect transistor inserted between one end part of said secondary winding and a negative electrode terminal of said secondary side smoothing capacitor;

a second field-effect transistor inserted between another end part of said secondary winding and the negative electrode terminal of said secondary side smoothing capacitor;

a first driving circuit for detecting, by a

resistive element, a secondary winding voltage corresponding to a half-wave period that said first field-effect transistor is to make a rectified current flow, and outputting a gate voltage for turning on said first field-effect transistor; and

a second driving circuit for detecting, by a resistive element, a secondary winding voltage corresponding to a half-wave period that said second field-effect transistor is to make a rectified current flow, and outputting a gate voltage for turning on said second field-effect transistor; and

magnetic flux density of said isolated converter transformer is set to a predetermined value or lower so that the secondary side rectified current flowing through the synchronous rectifier circuit as a result of said rectifying operation is in a continuous mode irrespective of variation in a condition of a load connected to said secondary side direct-current voltage.

2. The switching power supply circuit as claimed in claim 1, wherein,

in order to set the magnetic flux density of said isolated converter transformer to a certain value or lower, a coupling coefficient between the primary side and the secondary side is set to a predetermined value or

less by making a gap length formed in the isolated converter transformer a predetermined value or more.

3. The switching power supply circuit as claimed in claim 1, wherein,

in order to set the magnetic flux density of said isolated converter transformer to a certain value or lower, numbers of turns of said primary winding and said secondary winding are set such that a voltage level induced per turn of said secondary winding is a required value or lower.

4. The switching power supply circuit as claimed in claim 1, further comprising a constant-voltage control unit for performing constant-voltage control on said secondary side direct-current output voltage by variably controlling switching frequency of said switching unit according to a level of said secondary side direct-current output voltage.

5. The switching power supply circuit as claimed in claim 1, wherein,

a litz wire band formed by aligning a plurality of litz wires having elemental wires of a wire diameter less than a required value and forming the plurality of litz wires into a band shape is wound as the secondary winding of the isolated converter transformer.

6. The switching power supply circuit as claimed in claim 1, wherein,

a flat woven wire formed by weaving a plurality of litz wires having elemental wires of a wire diameter less than a required value into a flat shape is wound as the secondary winding of the isolated converter transformer.

7. The switching power supply circuit as claimed in claim 1, wherein,

a laminated film band formed by laminating a plurality of film-shaped conductors having a cross-sectional area less than a required value, the film-shaped conductors being covered with an insulating film, is wound as the secondary winding of the isolated converter transformer.

8. The switching power supply circuit as claimed in claim 4, claim 5, or claim 6, wherein,

both end parts of said litz wire band, said flat woven wire, or said laminated film band are preliminarily soldered, and then each soldered to a lead wire.